(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 535 906 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **92308849.6**

(51) Int. Cl.[5] : **A61B 17/04**

(22) Date of filing : **29.09.92**

(30) Priority : **30.09.91 GB 9120871**

(43) Date of publication of application :
07.04.93 Bulletin 93/14

(84) Designated Contracting States :
DE ES FR IT

(71) Applicant : **RICHARDSON, Margaret Pamela**
Lluest, Cynwyl Elfed
Carmarthen, Dyfed SA33 6TL (GB)

(71) Applicant : **RICHARDSON, Philip**
Lluest, Cynwyl Elfed
Carmarthen, Dyfed SA33 6TL (GB)

(72) Inventor : **RICHARDSON, Margaret Pamela**
Lluest, Cynwyl Elfed
Carmarthen, Dyfed SA33 6TL (GB)
Inventor : **RICHARDSON, Philip**
Lluest, Cynwyl Elfed
Carmarthen, Dyfed SA33 6TL (GB)

(74) Representative : **Austin, Hedley William**
Urquhart-Dykes & Lord Alexandra House 1
Alexandra Road
Swansea West Glamorgan SA1 5ED (GB)

(54) Suturing apparatus.

(57) Surgical suturing apparatus comprises upper and lower jaw elements (4,5) selectively movable relative to one another between open and closed position. Each jaw element is provided with a respective recess (11, 14) arranged to receive a portion (12, 15) of an elongate incision member or length of surgical thread and securing means (19, 19a, 19b) is provided arranged to selectively secure the surgical incision member or length of surgical thread (13) in a respective recess. The jaw elements are typically provided at an end of an elongate positioning and operating arm (2) making the device particularly useful for use in laparoscopic surgery.

EP 0 535 906 A2

The present invention is concerned with surgical apparatus for sewing and suturing.

A common surgical procedure for attaching materials together is sewing. In the case of surgical procedures a wound is closed by the manual application of a suture thread installed by means of a needle attached to the suture thread. Needle passage through tough tissue is often necessary and as such the needle must be rigid and sharply pointed. In the case of surgical suturing the needle is sometimes positioned and manouvered by the use of instruments to avoid direct handling of the needle. Even so the medical operative often experiences difficulty forcing the needle through tissue. This has limited the application of suturing to tissues which are readily accessible to the surgeon. The forceful use of a sharp needle sometimes results in needle stick injury to medical personnel. Needle stick injury has been cited as a probable cause for transmission of disease from medical personnel to patient and vice-versa. In particular, suturing or sewing of internal body tissue is extremely difficult in laparoscopic surgery, where suturing instruments must necessarily be operated remote from the tissue being sutured since the instrument must pass along a trocar into the body of the patient.

According to the invention, there is provided surgical apparatus comprising upper and lower jaw elements selectively movable between a first position in which portions of the respective jaw elements are positioned relatively close together and a second position in which said portions of said respective jaw elements are positioned relatively further apart, each of said jaw elements being provided with a respective recess or channel arranged to receive a portion of an elongate surgical incision member or length of surgical thread, and respective selectively actuable securing means arranged to secure said surgical incision member or length of surgical thread in a respective said recess or channel relative to said respective jaw elements.

It is preferred that the upper and lower jaw elements are pivotally movable relative to one another, with advantageously one of the upper or lower jaw elements being pivotally connected to the remaining jaw element or a member to which the remaining jaw element is connected.

Typically, selective relative motion is preferably effected by means of exertion of force by an actuation member on one of the respective jaw elements. The force actuation member may exert alternately compressive, and tensile forces on the respective jaw element in moving said jaw elements between said first and second positions, and may be actuated by means of mechanical linkage, hydraulic actuation, pneumatic actuation or electrical means (e.g. actuation by means of solenoid).

Typically, where pivotal relative motion of the jaw elements is effected by exertion of a tensile/compressive force on one of the jaw elements, the respective jaw element is provided with an extended lever portion extending away from the pivotal connection to which the tensile force actuation member is connected.

It is preferred that the recesses (or channels) provided in respective upper and lower jaw elements are configured and shaped such that the surgical incision member or portion of stiffened surgical thread may be selectively removed from either recess (or channel) whilst a respective portion of the incision member or thread remains secured in the other respective recess.

Advantageously, the incision member or portion of stiffened surgical thread is arcuately curved in its longitudinal direction. Typically the respective recesses (or channels) in upper and lower jaw elements are correspondingly arcuately curved along their length.

It is preferred that the respective recesses (or channels) in the upper and lower jaw elements are arranged such that respective spaced portions of the elongate incision member or portion of surgical thread may be received in both recesses (or channels) simultaneously. Advantageously one of the recesses (or channels) provided in a respective jaw element, preferably the lower jaw element, is in the forum of a hole or bore extending through the respective jaw. It is preferred that one of the recesses provided in a respective jaw element is in the form of a slot extending substantially wholly through the respective jaw element. Advantageously the slot tapers from a mouth portion to an apex portion. The presence of the slot in one of the jaw elements enables the surgical thread to be removed from the respective jaw members whilst the incision member is still received in the other jaw element, when the jaw elements are orientated in the second position.

The securing means preferably includes a respective securing element selectively actuable to engage respective portions of the incision umeimber or surgical thread or complementary engagenment formations provided thereon such that respective portions of the incision member or thread are secured relative to the upper or lower jaw element. Advantageously the securing elements are actuable so as to individually and separately selectively engage the respective portions of the incision member or surgical thread. Actuation of the securing elements may be by means of mechanical linkage, hydraulic actuation, pneumatic actuation or by electrical actuation (e.g. actuation by means of a solenoid).

Typically, upper and lower jaw elements are provided at the distal end of an elongate positioning arm, the proximal end of which arm is preferably provided with control means for controlling the actuation of the jaw element motion and of the securing means.

Advantageously, the elongate positioning arm is

substantially hollow such that mechanical linkages or hydraulic/pneumatic linkages may extend internally along the length of the arm from the control means at the proximal end of the arm to the jaw elements and securing means provided at the distal end of the arm.

Typically, the external dimensions of the elongate arm are such that the arm may be inserted and received in an elongate surgical trocar.

The invention will now be further described in a specific embodiment, suitable for use in laparoscopic surgery, by way of example only with reference to the accompanying drawings in which:

Figure 1 is a side elevation of surgical apparatus according to the invention;

Figure 2 is a detailed view of a part of the apparatus shown in Figure 1;

Figures 3 to 6 are views of the detailed part of the apparatus shown in Figure 2 in use; and

Figure 7 is a detailed plan view of the part of the apparatus of Figure 1 shown in Figures 2 to 5.

Referring to the drawings, and initially to Figure 1 in particular, the surgical apparatus generally designated 1 is intended for use as a suturing apparatus. The apparatus 1 comprises an elongate hollow arm 2 divided into two arm portions 2a and 2b connected together at a pivotal connection joint 23 such that arm positions 2a and 2b may pivot relative to one another. At one end of the arm 2 is a suturing arrangement 3 comprising an upper jaw extension 4 integral with the arm portion 2a and a pivotal lower jaw 5 pivotally connected to the arm portion 2a. At the opposite end of the arm 2 is a handle 6 to be gripped by the user, and actuation trigger 10 for controlling the operation of the suturing arrangement 3 as described below.

Referring now to Figure 2, the suturing arrangement 3 is shown in detail with pivotal connection 8 between the lower jaw 5 and arm portion 2a clearly shown. A lever extension portion 5a of the lower jaw 5 extends away from the pivot point 5 and is connected at its end to one end of a stiff actuation cable 9. The actuation cable 9 extends internally along the length of the arm 2 and is connected at its other end to the actuation trigger 10. Movement of the actuation cable 9 along the length of the arm 2 towards or away from the suturing arrangement 3 by means of manipulation of the actuation trigger 10 will cause the lower jaw 5 to pivot about pivot point 8 and the jaws to move relative to one another towards an open position with jaws 4,5 splayed apart (as in Figure 3), or a closed position with jaws 4,5 relatively close together (as in Figure 1), respectively.

The lower jaw 5 is provided with a bore 11 of circular cross-section extending therethrough from the upper surface of the jaw. In use, the incisor end 12 of an adapted surgical needle 13 may be snugly received in the bore 11. The upper jaw 4 is provided with a generally V shaped slot 14 extending right the way through the upper jaw 4 (as is best shown in Figure 7). in use, the trailing end 15 of the adapted surgical needle (which is attached to suturing thread 16) may be received snugly in the apex 17 of the "V" shaped slot 14 with the incisor end 12 of the needle 13 extending downwardly from the upper jaw 4 and the suture thread 16 extending upwardly from the upper jaw 4. In the open position as shown in Figure 5, thread 16 may be removed from the slot 14 in the upper jaw 4 by moving the thread to relatively towards the mouth 18 of the "V" shaped slot 14 in the direction shown by arrow A in Figure 7.

A flexible resilient "U" shaped metal securing member 19 having securing arms 19a and 19b which are constrained to move along defined guide channels (not shown) in the upper and lower jaws 4,5 is provided. The upper arm 19a of the securing member 19 is connected to one end of a second stiff actuation cable 20 which also extends along the length of the arm 2 to the actuation trigger 10. Further movement of the actuation trigger 10 once it has been moved to either open or close the jaws 4,5 causes the respective securing arms 19a and 19b to slide along their defined guide channels in respective jaws 4,5 and intersect the "V" shaped slot 14 or bore 11 respectively. Where a respective portion of the adapted needle 13 is present in the bore 11 or slot 14, the respective arm 19b, 19a will engage with that a respective notch portion 25a, 25b of the needle 13 and secure it in the slot or hole.

As shown in the drawings, due to the securing action of the securing member 19, when securing arm 19a intersects slot 14 and engages notch 25a in needle 13, the arm 19b is withdrawn from bore 11, and vice versa. Thus at all times, the needle is positively secured in either jaw 4 or jaw 5.

It should be noted at this point that whilst the device is described for use with an adapted needle, a suture thread with a suitably stiffened end portion would serve adequately, negating the necessity for a needle.

The thread 16 extends upwardly out of the slot 14 in the upper jaw 4, and then re-enters the hollow arm 2 through an aperture 21. The thread then extends internally along the length of the arm 2 where it is connected at the handle end of the device to a spool (not shown).

In use, the apparatus is loaded with needle 13 attached to thread 16 by inserting the needle through slot 14 and with the tip 12 extending into bore 11. Upper securing arm 19a is then actuated forwardly by means of manipulation of the trigger 10 to intersect the slot 14 and engage in notch 25a in the upper portion 15 of the needle 13 and securely hold the needle 13 in the slot 14 relative to the upper jaw 4. At this stage the condition of the apparatus is as shown in Figure 2 with the lower securing arm 19b retracted from the bore 11.

Next the trigger 10 is manipulated to push control cable 9 forward causing the lower jaw 5 to pivot about pivot mechanism 8 to the open position shown in Figure 3. It should be noted that the securing arm 19a remains in engagement with the upper portion 15 of the needle 13 and is thereby secured in slot 14. Body tissue to be sewn is then placed between jaws 4 and 5 as shown in Figure 3 with the needle tip 12 located above the tissue.

Subsequently, as shown in figure 4, the cable 9 is retracted causing jaws 4,5 to pivotally close, in so doing forcing the needle 13 through the tissue 24 such that the needle tip 12 is relocated in the bore 11. Once this stage has been effected, cable 20 is retracted causing the "U" shaped securing member to slide and flex along its length with the lower arm 19b intersecting the bore 11 and engaging with notch 25b in the tip 12 of the needle 13, securing the needle relative to the lower jaw 5. The jaws 4,5 are then opened by forward motion of cable 9 as previously described causing needle 13 to be pulled clean through the tissue 24.

The next step, as shown in Figure 5, is for the thread 16 to be removed from the slot 14 by moving the arm 2 in the direction of arrow B, causing the thread 16 to move relatively from the apex 17 of the slot 14 towards the mouth 18 in the direction of arrow A in Figure 7. As can be seen in Figure 5, once this stage is reached, the needle 13 is secured in the lower jaw 5 with needle 13 and thread 16 passing through the tissue 24. The thread 16 is then pulled further through the tissue 24 and the jaws 4,5 subsequently closed as described previously, causing the upper needle portion 15 to re-engage in slot 14. The upper securing arm 19a is then re-engaged in slot 14 (causing the lower securing arm to be simultaneously retracted from blind bore 11) securing the needle relative to the upper jaw 4 as shown in Figure 6. by this stage, a complete pass of the suture thread 16 through tissue 24 has been completed, and further passes may be made by repeating the steps outlined above and described in relation to Figures 2 to 6. To enable the suture thread local to the needle to re-engage slot 14, a portion of it is relatively stiffened during manufacture, typically by the application of a stiffening agent e.g. epoxy resin. The stiffened portion of the thread whilst being flexible enough to pass through the tissue would direct the thread to return to slot 14 thus enabling the end 15 of the needle 13 to re-engage in slot 14.

The apparatus described enables suturing to be effected easily and efficiently, with the medical operative remote from the needle tip and tissue being sutured.

Claims

1. Surgical apparatus comprising upper and lower jaw elements selectively movable between a first position in which portions of the respective jaw elements are positioned relatively close together and a second position in which said portions of said respective jaw elements are positioned relatively further apart, each of said jaw elements being provided with a respective recess or channel arranged to receive a portion of an elongate surgical incision member or length of surgical thread, and respective selectively actuable securing means arranged to secure said surgical incision member or length of surgical thread in a respective said recess or channel relative to said respective jaw elements.

2. Surgical apparatus according to claim 1, wherein said recesses or channels provided in respective upper and lower jaw elements are configured and shaped such that the surgical incision member or portion of surgical thread is selectively removable from either recess or channel whilst a respective portion of the incision member or thread may remain secured in the other respective recess or channel.

3. Surgical apparatus according to claim 1 or claim 2, wherein the incision member or portion of stiffened surgical thread is arcuately curved in its longitudinal direction, the respective recesses (or channels) in upper and lower jaw elements being correspondingly arcuately curved along their length.

4. Surgical apparatus according to any preceding claim, wherein one of the recesses or channels provided in a respective jaw element is in the form of a slot extending substantially wholly through the respective jaw element.

5. Surgical apparatus according to claim 4, wherein the slot tapers from a mouth portion to an apex portion.

6. Surgical apparatus according to any preceding claim, wherein the securing means includes a respective securing element selectively actuable to engage respective portions of the incision member or surgical thread or complementary engagement formations provided thereon such that respective portions of the incision member or thread are secured relative to the upper or lower jaw element.

7. Surgical apparatus according to claim 6, wherein the securing elements are actuable so as to indi-

vidually and separately selectively engage the respective portions of the incision member or surgical thread.

8. Surgical apparatus according to any preceding claim, wherein said upper and lower jaw elements are provided at the distal end of an elongate positioning arm, the proximal end of which arm is preferably provided with control means for controlling the jaw element motion and of the securing means.

9. Surgical apparatus according to claim 8, wherein the external dimensions of the elongate arm are such that the arm may be inserted and received in an elongate surgical trocar.

10. Surgical apparatus according to any preceding claim, wherein selective relative motion of the upper and lower jaw elements is effected by means of exertion of force by an actuation member on one of the respective jaw elements.

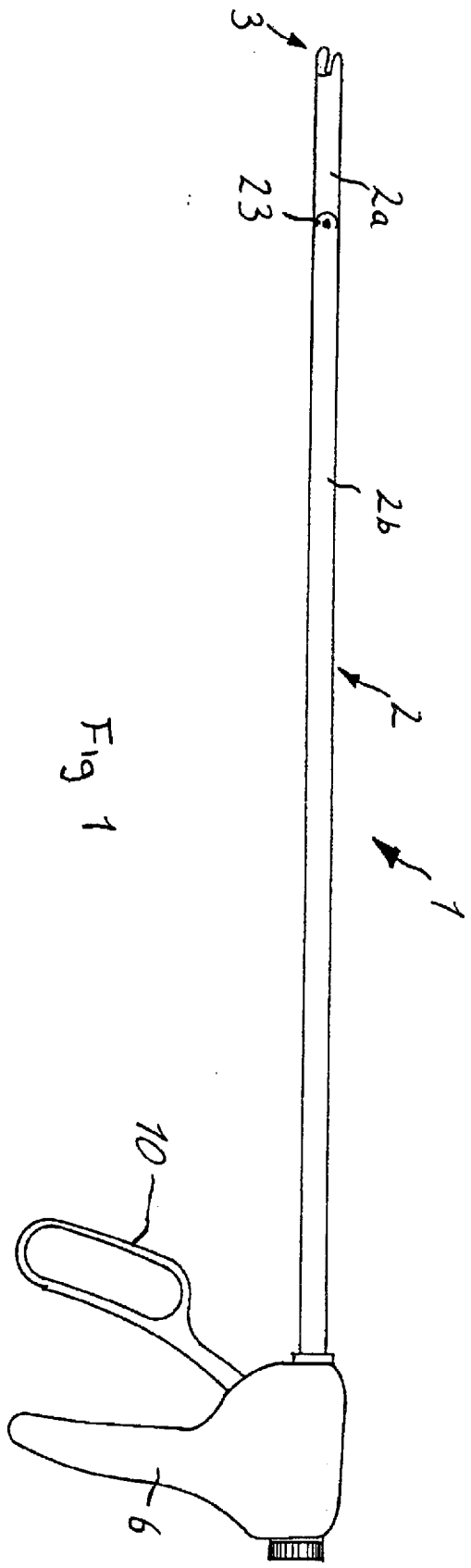

Fig 1

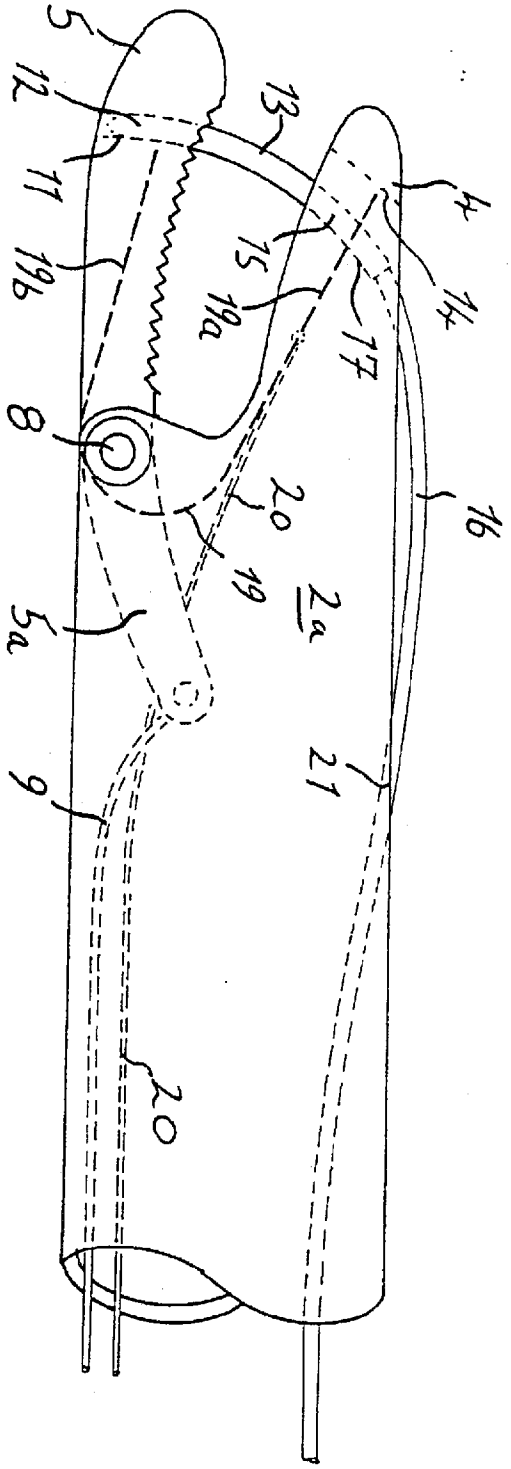

Fig 2

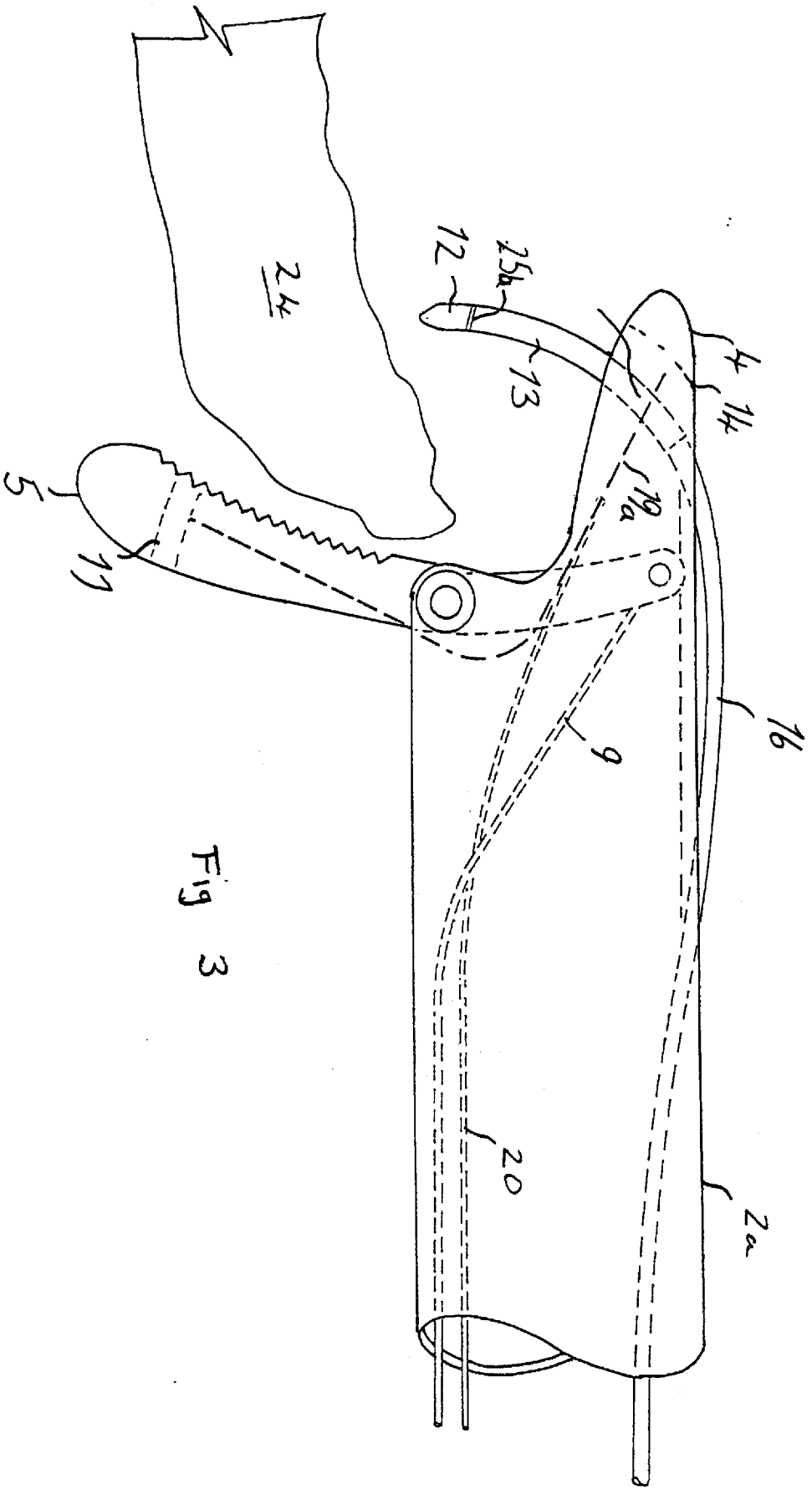

Fig 3

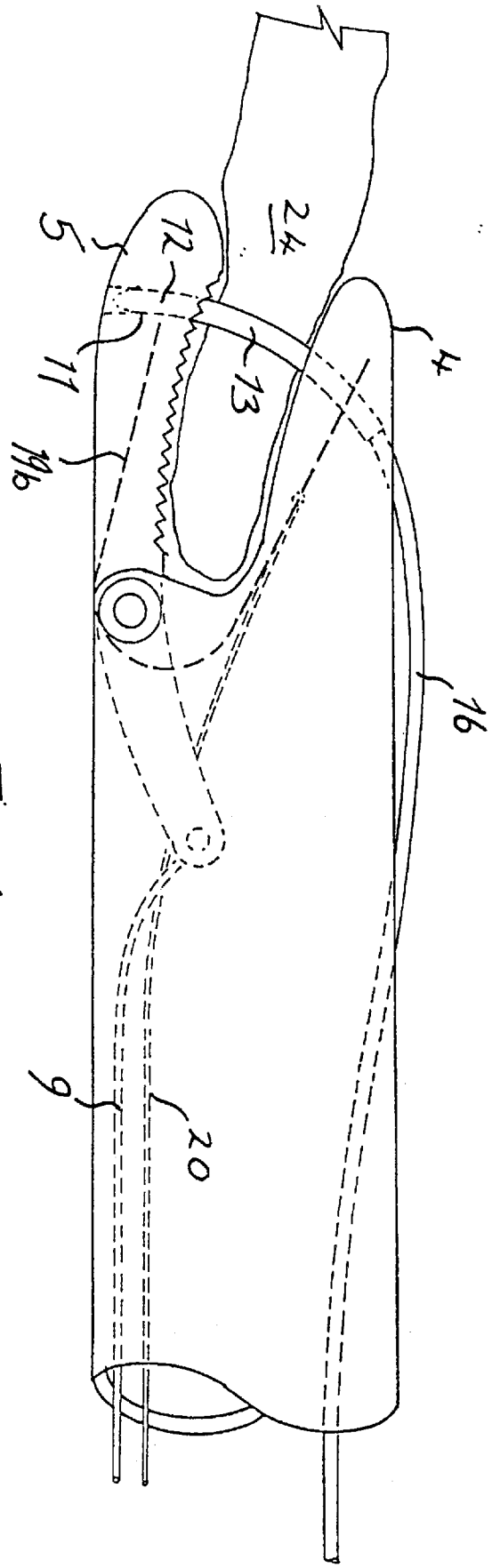

Fig 4

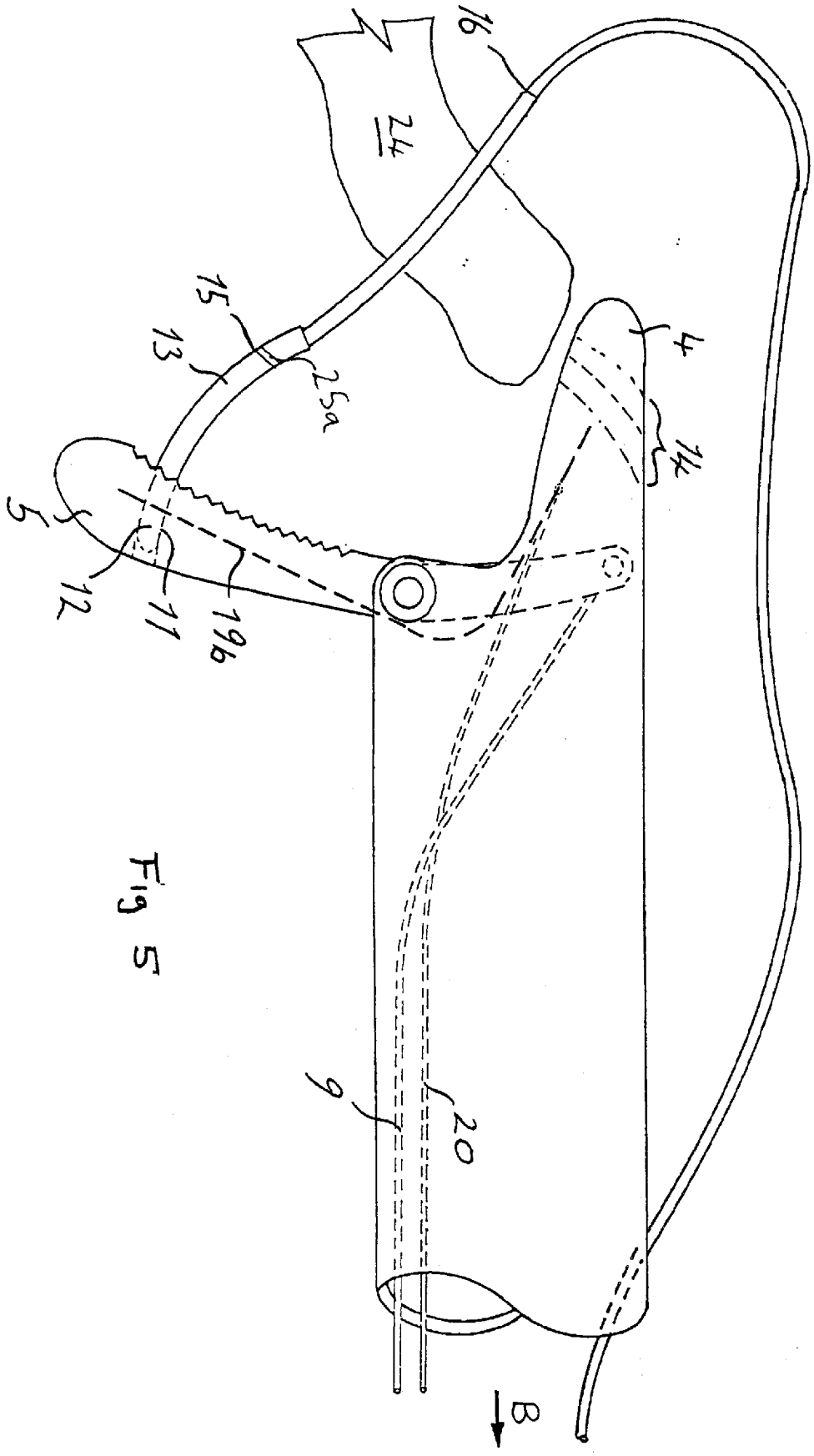

Fig 5

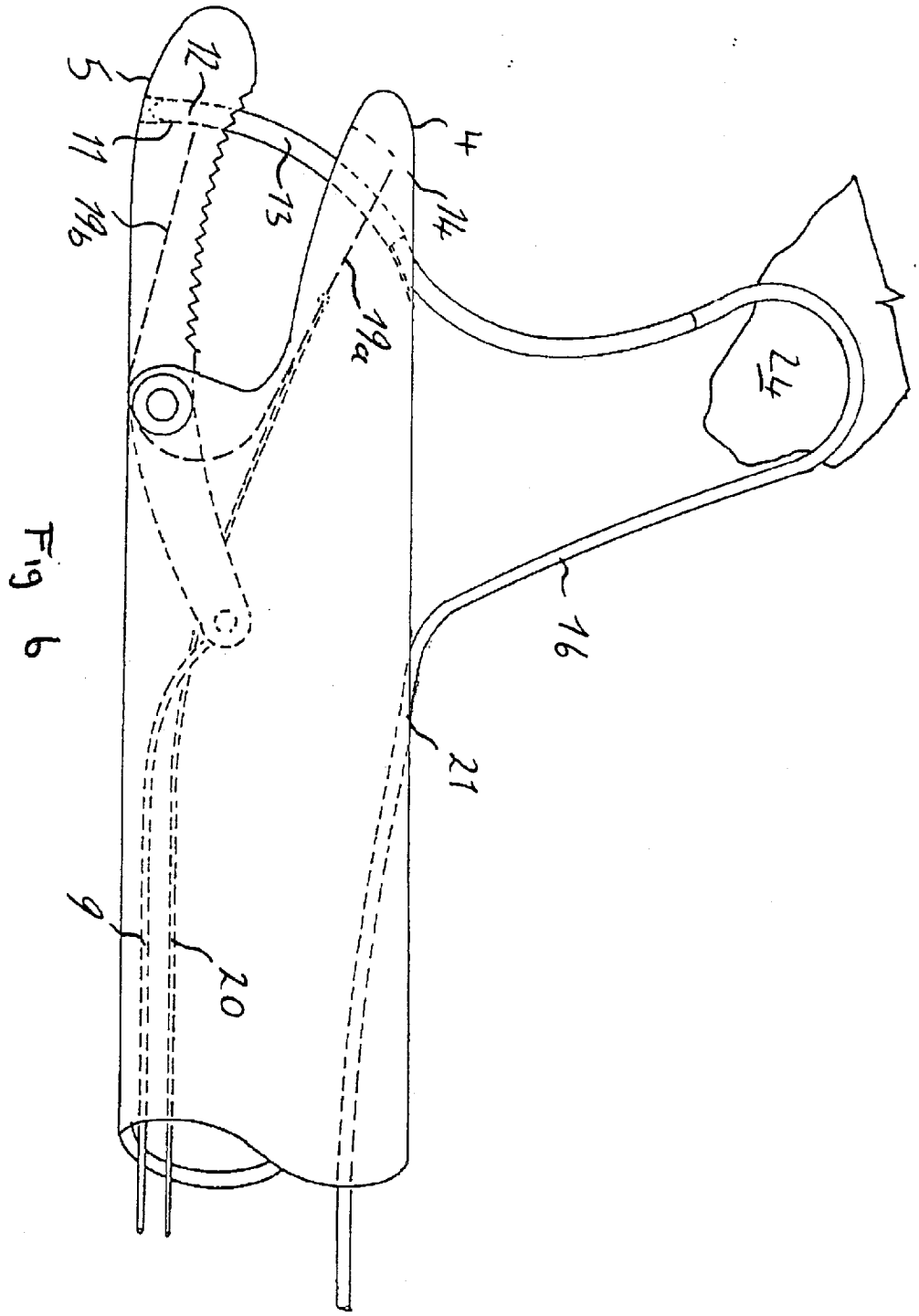

Fig 6

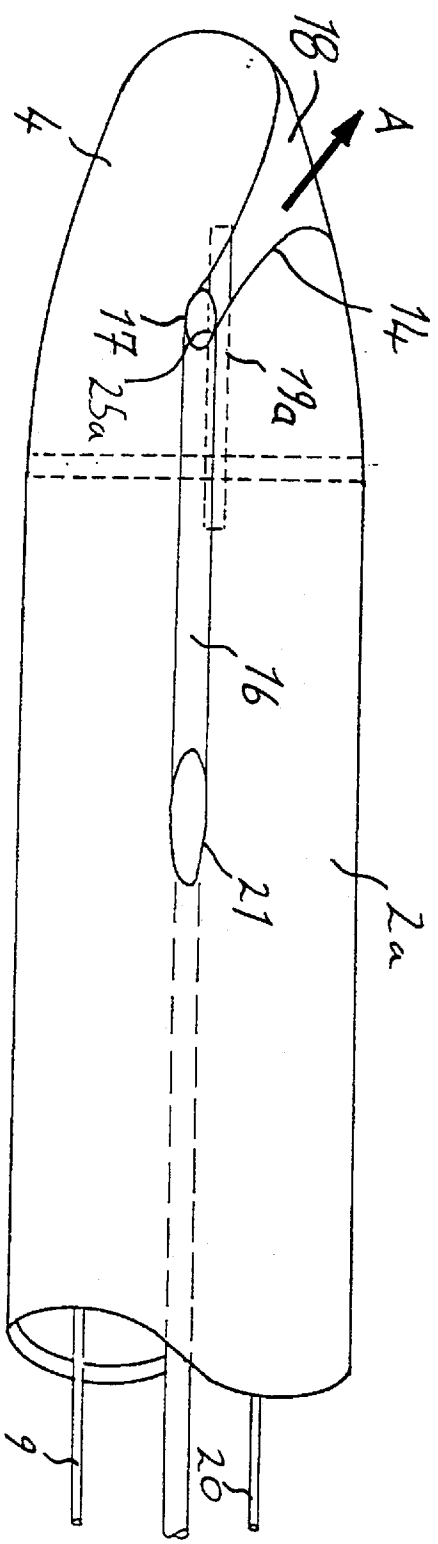

Fig 7